Relationship between Road Network Characteristics and Traffic Safety

Performing a comprehensive evaluation of urban intersection crashes in San Antonio, TX , identifying causes, and recommending effective countermeasures

Due to budget constraints and the relatively low traffic volumes on some roads, it is often not cost-effective to upgrade the road infrastructure nor is it warranted to implement active traffic control devices (such as traffic lights) to improve safety. Sometimes, it may even be counterproductive to implement certain traffic control systems. Although appropriate signage and improved infrastructure might alleviate the problem, often these intersections do not meet the MUTCD traffic signal warrants. In terms of pedestrian safety, signals may be too far apart, which prompts authorities to apply treatment in between (e.g. mid-block crossing for pedestrians who are not willing to walk to the nearest intersection/signal). However, excessive placement of traffic signals and other signage might negatively affect the reaction of drivers and raise driver expectancy issues. The city of San Antonio population continues to grow due to the strong economic development, and this growth has led to congested traffic and increased crashes. The proposed research aims to: (1) perform a thorough analysis of critical intersections with high crashes within the city of San Antonio, TX, (2) analyze key factors leading to root causes, and (3) recommend effective safety countermeasures. congestion and emissions.

Problem Statement

Road safety is typically defined in terms of the injuries and fatalities that occur on the roadway system - and are often based on crash outcomes (such as the number of crashes, by kind and severity) expected to occur over a period of time. The science of safety has evolved over the past several years and is focusing more on data and analysis, rather than solely adhering to standards. Science-based road safety management is referred to as data-driven or evidence-based. This approach to road safety emphasizes estimates of the effect on safety (data and analysis), rather than adherence to standards based on personal experience, beliefs, and intuition.

Roadway and human factors, among other factors, affect the level of safety at intersections.

For example, past research has determined that intersections near horizontal or vertical curves tend to have higher crash rates than intersections located on tangent sections of highway. Also, some studies postulate that drivers may find it difficult to estimate the inter-vehicle gaps in high speed traffic flows coming from opposite directions - or drivers turning left may have more difficulty judging gaps in the far side of traffic coming from the right, compared to the near side of traffic coming from the left. This difficulty increases at intersections located on horizontal curves where drivers find it equally difficult to find a safe gap in either direction.

The motivation of this study was initiated by the City of San Antonio (COSA). The fast growth due to the economic development in South Texas (as a result of booming oil and gas activities) has created a spike in crashes and fatalities in the region over the last four years. Primarily, these crashes involved commercial vehicles within and outside urban city limits and across the South Texas region. As a result, the state of Texas, local governments and municipalities have designated the region as a focus priority and directed funding to address this safety issue. The research team have been challenged to find data sources to adequately identify the root causes for these crashes - and to identify effective counter-measures to state agencies. Therefore, the research team identified that leveraging existing data/databases and conducting site visits to "intersection hot spots" the first step towards finding a solution.

Summary

The objective of this study is to perform a comprehensive evaluation of urban intersection crashes in COSA, identify root causes, and recommend countermeasures. Currently, the research team has conducted a thorough review lated past research and reports from Texas, across the country, and internationally. The research team has also investigated operational and safety data from various sources. The research team has started examining spatiotemporal indicators that
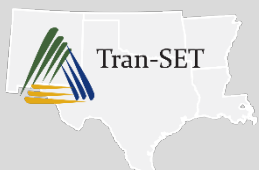
may reveal information about the correlation between crash numbers and traffic volumes, intersection characteristics, and other factors.

This study will also include using different data collection techniques to observe driver behavior at select isolated rural intersections (through site visits). This study will eventually produce accurate information on the expected benefits of engineering and educational countermeasures in terms of crash rate reductions, as well as the costs of the countermeasures and how long they are expected to provide a benefit.

Findings

The research team has started analyzing crash data. The figures below show preliminary results for the year 2013. As expected, most of the crashes in COSA where concentrated in the downtown area (see Figure 1). The majority of crashes involved persons between 15 and 34 years of age (see Figure 2). Also, the majority of crashes occurred on weekdays during the afternoon time period (see Figure 3).
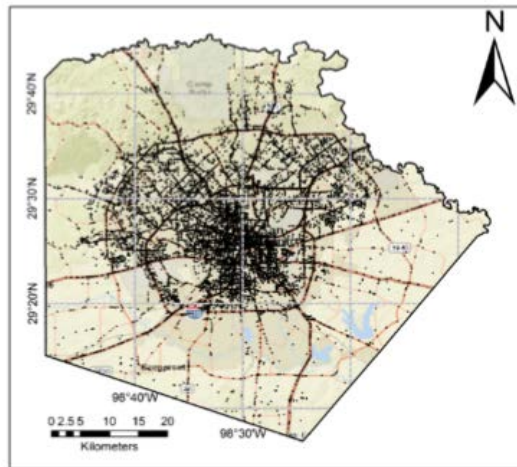

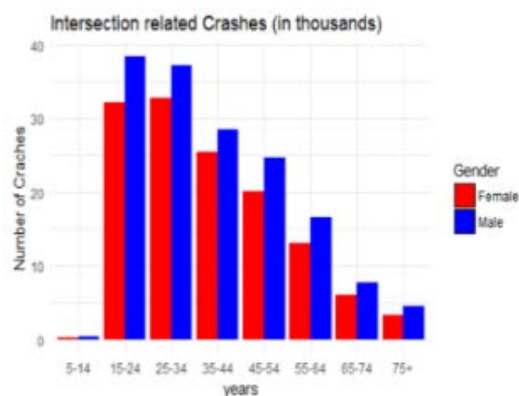**Figure 1. The spatial distribution of crashes in San Antonio for 2013.**

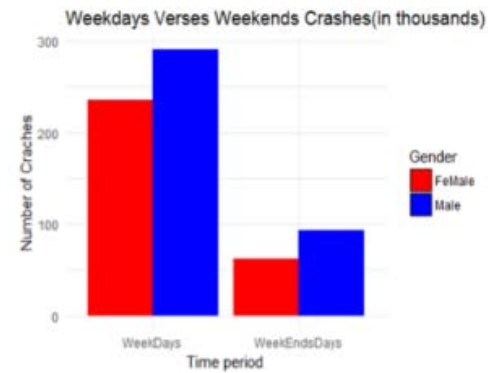**Figure 2. Intersection related crashes.**

Figure 3. Temporal distribution of intersection crashes.

Impacts

- A major outcome of this study is identifying serious crash types on urban intersections in order to reduce fatal and serious injury crashes.

- A step-by-step approach to allocate available databases in the state, optimize and filter relevant data, conduct systematic and extensive data analysis and propose solutions for implementations will be developed.

- The approach will help traffic engineers process crash and traffic data, estimate their accuracy, identify and analyze roadways safety problems and opportunities, select the most effective strategies to address them, determine project limits, and evaluate the priority of proposed improvements.

- The developed approach will allow the research team to determine ways to address safety issues at hotspot intersections and provide the safest possible solutions for motorists and members of the local communities.

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

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